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Testimony of John R. McBride
before the

Natural Resources Committee
Montana House of Representatives
Helena, Montana

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State Actions to Promote Energy Conservation

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State Actions to Promote Energy Conservation

M. ERPD
Project

My name is John Raymond McBride. I reside at 3900 Jupiter Lane, Butte, Montana. I am currently employed as an environmental systems specialist for the Montana Energy and MHD Research and Development Institute, Inc., Butte, Montana. I received a bachelor's degree in mathematics from Westminster College, New Wilmington, Pennsylvania, and master's degrees in chemical physics and environmental studies from the University of Montana. For the past three months, I have been project leader on a contract from the Montana Energy Advisory Council to provide technical assistance in developing an energy conservation plan for the state of Montana.

I wish to note at the outset that I will be presenting testimony based on the research of all fourteen members of our energy conservation team. I am by no means an expert in all areas of energy conservation. For instance, I am neither a mechanical engineer or an architect. Specifically, investigations conducted by Mr. David Baylon and Mr. Davis Straub of the Ecotope Group in Seattle, Washington, Mr. Patrick Binns of Helena, Montana, and Ms. Karen Barclay and Ms. Susan Brown of MERDI are central to my testimony tonight.

I have been asked tonight to address the following question:

> "What potential effects can state actions encouraging conservation have on Montana's natural gas demand? Using existing reports on Montana's natural gas demand situation for the 1975-1995 period, identify as precisely as possible the effects of various energy conservation measures on the demand for natural gas in Montana. Please provide documentation for your estimates."

In answer to this question, I can say without hesitation that state actions to promote energy conservation can have a very substantial effect on the demand for natural gas. I wholeheartedly support Governor Judge's

position that Montana should become the nation's leader in conservation of energy resources and elimination of waste in their usage. I also agree that the number one priority and basic cornerstone of Montana's energy policy must be energy conservation through the reduction of energy demand and that any other course would be ultimately suicidal.

Energy conservation is defined to be the efficient utilization of energy. Energy conservation does not necessarily imply curtailment. We do not propose to conserve energy by closing Montana's industries or by not heating Montana's homes. Instead, we propose to conserve energy by making equivalent amounts of energy do much more for us. This can be done by substituting another resource (capital, skilled labor, time, careful workmanship) for energy; it also can be accomplished either by consuming less of or a different mix of the goods and services requiring energy. We do not view energy conservation and renewable energy development as being counter to Montana's economic development plans. Energy conservation will create jobs. Both energy conservation and renewable energy development are labor intensive rather than capital intensive since their application primarily is in decentralized small-scale and individual use.

Governor Judge's choice of conservation as the cornerstone of a state energy policy is well founded. Conservation can be one of the state's major energy supply technologies. It is assuredly the cheapest way to make new supplies of energy available to Montana. No one can tell the difference between a Btu of energy conserved and made available for some other use or an additional Btu produced from one of our various energy supplies. The only distinquishing characteristic is that a Btu conserved will cost substantially less than an additional Btu supplied. Documentation

for this statement will be furnished in the following testimony.

We have proposed in the Montana Energy Conservation Plan measures to reduce the energy demand in all sectors of Montana. Since natural gas demand is at issue at tonight's hearing, my testimony will focus on state actions to implement conservation in the residential, commercial, industrial, and government sectors of our economy.

Let us first review the residential sector. The residential sector consumes about 15 percent of the energy used in Montana. Eighty-eight percent of this energy is used for space and water heating. Two thirds of the energy used in the residential sector comes from natural gas. We have enumerated a number of programs which can save energy (particularly natural gas) in the residential sector.

As a first step, the state of Montana could enforce a statewide energy conservation building code. The enactment and enforcement of a statewide energy conservation building code by January 1, 1978 is one of the mandatory requirements of the FEA energy conservation program.

The state of Montana is fortunate in that it already has a statewide building code. In fact, the 1975 legislature empowered the Building Code Council, which administers the code, with the authority to draft regulations containing energy saving criteria. The council simply has delayed adoption of any energy saving standards until nationally recognized standards are developed.

We recommend that the legislature require that the Montana Building Code be revised by January 1, 1978 (sooner if possible) to include energy

conservation standards (thermal and lighting efficiency standards) for all new construction and major renovations. The Building Code Council should be mandated to conduct a technical evaluation of appropriate revisions of ASHRAE 90-75 and other code models. These revisions should include consideration of upgraded insulation standards, thermal shutters, and direct solar gains as a minimum. Public hearings will be required for citizen input to the selection of standards and adoption of procedures for certification and enforcement.

An appropriation of $100,000 is recommended to provide for additional technical staff and contracted services necessary to evaluate and adopt an energy conservation building code and to prepare training sessions and manuals for local code enforcement officials. The bulk of this appropriation would be used to educate local building code officials.

Using methodology and data supplied by the Federal Energy Administration, we calculate that 2.03 trillion Btu's of energy would be saved in the residential sector in 1980 by enforcing a statewide building code equivalent to ASHRAE 90-75.

Unfortunately, the FEA data is not really appropriate to Montana. New residential construction in Montana generally approaches ASHRAE 90-75 at the current time. Substituting Montana data, we find that a statewide building code equivalent to ASHRAE 90-75 would conservatively save on the order of .8 trillion Btu's. This energy saved would cost the home owner between 35¢ and $1.00 per million Btu's.

The state of Montana could adopt energy conservation building code standards more stringent than ASHRAE 90-75. These standards are cost

effective and would cause an energy savings of over 50 percent of the energy used in an average Montana house for space and water heating. Energy savings of 2 trillion Btu's in 1980 in the residential sector would result from the application of these standards.

Conserving energy in the existing stock of houses and apartment buildings must be a high priority objective if the available reserves of natural gas are to be extended by substantial reductions in current demands. One of the major factors that limits the power of homeowners to implement energy conservation measures is the availability of capital. We recommend that the principal of the new state coal tax trust fund be invested in the banking community (including savings and loans and credit unions) within the state of Montana at a preferentially low rate of interest on the condition that the banking community, in turn, make low interest energy conservation loans available to all sectors of the economy. The interest from the trust fund could be used as a default guarantee. Such in-state investment of funds will have a multiplier effect throughout the state's economy, and the program, in fact, may make money for the state rather than cost the state money. If the conservation loan program increases the residential energy conservation renovation rate from an assumed 1 percent per year to 3 percent per year, an additional 1.2 trillion Btu's of energy would be saved in addition to the building code savings. We assume here that the houses are renovated to our more stringent standards.

Montana has nearly 30,000 low-income households that are eligible for energy conservation renovations through the federal weatherization program. Evaluations of weatherized homes demonstrate energy savings ranging from 20 to 40 percent of previous energy consumption levels. The federal

government provides three-to-one matching funds through the Community Services Administration and Social Security program for local and state weatherization actions. The matching funds for Montana's weatherization projects have all come from local government appropriations.

We recommended that an appropriation of $300,000 be made to the Department of Community Affairs for a greatly expanded weatherization program. The combined state and federal funds (expected $1,200,000) should be allocated to local agencies over scheduled periods, with some funding preference given on the basis of local funding efforts. The Department should review each local program's performance prior to the approval of subsequent requests for weatherization funds.

If this program is continued through 1980, at least $2.4 million will be made available. Labor funds allocated from other sources (CETA, for example) will increase the value of the weatherization program even further. If we assume that 8,000 homes are weatherized through this program and that each house reduces its energy consumption by 20 percent, .29 trillion Btu's will be saved in 1980. The cost of this program works out to be less than 50¢ per million Btu's saved.

Our research has shown that in almost every case, conservation measures are less costly than comparable electricity or fossil fuel supplies. Educational efforts to inform Montana citizens of the benefits of energy conservation will be able to effect savings in both new and existing homes. Consequently, education programs may be able to save an additional 2 percent of the projected base energy consumption in the residential sector in 1980. This amounts to 1.3 trillion Btu's saved in 1980.

Presently, the consumer economics of renewable energy conversion systems are inadequate to support a market demand. It is expected that the costs of these systems will decrease as economic scales of production are achieved in response to increasing consumer demand.

To stimulate the early stages of renewable energy system production, we recommend that the state enact a six year tax credit against state income tax liability for citizens purchasing and installing solar or wind energy systems on their principal residence or commercial establishment. This credit should be graduated in the following manner: 40 percent credit for the first $1,000 expense and 20 percent for the next $3,000 expense. This provides a maximum allowable credit of $1,000 to any citizen. A similar scale would provide a $3,000 maximum credit to commercial installations. Any remaining credit balance will be carried forward to subsequent taxable years until the full eligible credit has been received.

The renewable energy tax credit would speed the utilization of renewable energies by reducing their costs relative to existing fossil fuel costs. By encouraging renewable energy use, this measure provides us with both greater experience with renewable sources now so that they will be seen as feasible later and encourages a reduction in capital costs by providing an expanded market for renewable energy technologies.

The tax credit will definitely encourage solar hot water heaters. Solar hot water heaters can provide up to 80 percent of the average Montana domestic hot water heating needs at reasonable cost, about $1,000 per heater. This cost is reduced to $600 per heater by the tax credit. The life cycle cost of the solar energy used is decreased from 2.96 mm/Btu to 1.77 mm/Btu

(about the cost of natural gas now). If we assume a 1 percent/year remodeling rate, 6,400 Montana homes in 1980 will have solar water heaters. This would represent a savings in fossil fuel and electricity of 180 billion Btu's (105 billion Btu's fossil fuel, 90 billion electricity). The cost to the state would be $2.6 million dollars.

The public utility rate structure also can influence energy conservation. We do not believe that the current declining block rate structure promotes energy conservation. For that reason, we have recommended that a detailed study be undertaken to develop an energy conserving and equitable utility rate structure. A rate structure which adequately reflects both cost of service and the long run marginal cost of producing additional energy supplies will encourage reduced energy demand. Assuming the utility rate structure study calls for conservation rates at the conclusion of the study in 1979, these new rates could have an effect in 1980 and on into the future. The quantity of energy saved, however, would depend on the specific rate structure adopted.

We have conservatively estimated that the combined effects of our programs on the residential sector energy demand in 1980 would be a savings of approximately 5 trillion Btu's. Looking out into the future in 1995, our stringent building code will be saving at least 11.2 trillion Btu's per year, the weatherization program will be complete and saving 1.1 trillion Btu's per year, and the conservation loan program will have stimulated over 6.7 trillion Btu's of additional savings. Finally, the intensive education program will have conservatively saved 5 percent of the projected baseline residential energy consumption for 1995 or 4.2 trillion Btu's over and above the other programs. Hence, the projected 1995 savings in the residential sector from our plan would be over 23 trillion Btus. A rough estimate for

1985 would be a 12 trillion Btu per year savings. If the current energy consumption pattern remains constant (a questionable assumption), our program will save 3.3 billion cubic feet of natural gas in 1980, roughly 8 billion cubic feet in 1985, and over 15 billion cubic feet per year by 1995. This natural gas savings, plotted against the MERDI baseline case described in other testimony, is shown in Figure 1.

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Our conservation programs will also impact the commercial sector of Montana's energy economy. The commercial sector also accounts for about 15 percent of the energy used in Montana. Of this, only about 75 percent is used directly in commercial buildings. In commercial buildings, about 62 percent of the energy used is for space heating and air conditioning. An additional 28 percent is used for lighting. In 1975, 17.6 trillion cubic feet of natural gas was sold to the Montana commercial sector. Every implementation strategy previously described for the residential sector also applies to the commercial sector.

Using the FEA methodology, the adoption of a statewide building code and lighting efficiency standards for all new construction and major remodeling will save 4.86 trillion Btu's of energy in the commercial sector in the year 1980. Our own calculations based on Montana data indicate that a statewide building code equivalent to ASHRAE 90-75 and the Illumination Engineers Society Lighting Standards would save about 2.6 trillion Btu's per year. Again, a standard more stringent than ASHRAE 90-75 would be cost effective and conserve more energy. The cost of the energy saved by this building code ranges from $1.10 to $1.70 per million Btu's for new construction and from $1.50 to $2.75 per million Btu's for retrofit work.

A peculiar aspect of the implementation of ASHRAE 90-75 or other more stringent building codes is the fact that it will decrease natural gas and other fossil fuel consumption at the expense of increasing electricity consumption. Even though electricity consumption for lighting may be reduced by up to 50 percent by adopting the Illuminating Engineers Society Standards, additional electricity will be required for such things as heat reclamation and recirculation systems and computerized temperature controls. Overall energy savings are still distinctly positive even though electricity consumption may increase.

The conservation loan program, the renewable energy tax credit, and education programs will all benefit the commercial sector. The conservation loan program will increase both the rate of conservation reconstruction and and extensiveness of the conservation renovations. The renewable energy tax credit will stimulate the use of passive solar heating design, solar collectors, and the use of solar energy for water heating. Educational programs will have their primary effect on existing commercial buildings which do not meet stringent energy conservation standards. Here it has been found that energy savings of 10 to 20 percent are possible simply by educating maintenance personnel and building users about the efficient management of thermostat settings, illumination levels, hot water temperature control, proper equipment maintenance, and variable ventilation requirements.

In terms of natural gas demand in the commercial sector, neglecting the conserving effects of education programs and utility rate reform, we estimate that the adoption of a statewide building code will save 2.6 billion cubic feet of natural gas in Montana's commercial sector in 1980. The conservation loan program and the renewable energy tax credit combined

could save an additional 1.6 billion cubic feet in the commercial sector in 1980.

Farther into the future, the combined natural gas savings in the commercial sector for 1985 would amount to approximately 7.4 billion cubic feet, and in 1995 the gas savings would be 14.6 billion cubic feet. The application of a statewide building code equivalent to ASHRAE 90-75 alone would result in a savings of 5.3 billion cubic feet in 1985 and 9.7 billion cubic feet in 1995. The effect of these measures on the MERDI baseline natural gas demand projection is shown in Figure 2.

The Montana state government itself can effect significant energy savings in its own operation. For instance, in fiscal year 1975, eleven Montana state government building complexes consumed over 1.7 billion cubic feet of natural gas. Warm Springs State Hospital, where natural geothermal water flows to the surface, consumed 250 million cubic feet of this total. We have recommended a number of measures by which the state of Montana could conserve energy in its own operation. Here, I will review specifically those measures which can conserve natural gas; however, care must be taken not to double count savings in government operation along with the savings already enumerated in the commercial sector which includes government.

We absolutely agree with Governor Judge that state government must serve as a model of energy conservation practices. Governor Judge's executive order to the Department of Administration to specify and put into effect more efficient management practices in the operation of existing state buildings can possibly save 10 to 20 percent of the energy consumed in existing state buildings, perhaps .2 trillion Btu's in 1980.

The Executive Building Program Proposal for 1977-1979 contains an appropriation of $200,000 to the Architectural and Engineering Division for establishing procedures and hiring personnel to conduct an energy use evaluation of selected state buildings. It is expected that 250 to 300 buildings would be audited to identify significant energy conservation potential; but no appropriation for corrective measures is requested. Rather than delay conservation retrofitting until the 79-80 biennium, we recommend an additional appropriation of $500,000 for the acquisition of conservation materials and installation in those buildings determined to have the greatest potential for energy conservation. These remedial funds also could be used in preparing and distributing conservation manuals for local and state building operations personnel.

The Division of Architecture and Engineering recently initiated the application of a non-mandatory life cycle cost evaluation of new state building projects. At this time, there is no statutory requirement that building decisions be based upon an optimized life cycle cost design; nor is the Division obligated to use a uniform analytical procedure for all reviews. The state government also purchases other energy-consuming equipment (e.g., motor vehicles, computers, and print reproduction equipment) which also should be subjected to life cycle cost review.

We recommend that the legislature statutorily require the Department of Administration to promulgate a uniform design and procurement procedure for major energy consuming purchases that includes standard features of life cycle cost analysis (such as estimates of inflation, fuel cost escalation, interest rates, etc.) and analysis of payback periods for energy conservation options over the installation's effective life. Expenditure decisions should be based upon optimized life cycle costs. The Department

of Administration should be appropriated $25,000 for preparing the life cycle cost analytical procedure, programming computer software necessary for the analysis, and paying for personnel and computer time required in the evaluation process.

In 1975, the legislature created a Renewable Resource Development Program (89-3601 RCM) to provide low-interest loans to ranchers and farmers for projects which conserve, utilize, or develop the state's renewable resources. In addition to the loan program, this law provides for grants to state agencies for conducting feasibility and design studies or for acquiring or constructing projects which similarly develop and utilize renewable resources. Such grants can be made only with the explicit authorization of the legislature.

Due to legal problems involving the bonding authority of this program, no loans have been awarded to date. The first round of grant reviews by the legislature is approaching, and there is an estimated $680,000 that could be appropriated for grants without interferring in the debt service and reserve account obligated for the imminent renewable resource bond issue. The potential to award grants for demonstrating innovative projects utilizing renewable energy resources should be promoted by the Department of Administration (in view of the statutory inclusion of "land, water, fish, and wildlife" in the accurate definition of renewable resources). We recommend that the renewable resource development program be supported and that administrative rules and procedures explicitly state that projects regarding renewable energy conversion (e.g., sunshine, winds, flowing water, and biomass) are eligible for the loan and grant funds.

Specifically, under the renewable energy demonstration grant program described above or with other sources of funding that may become available sooner, the state of Montana should give special consideration to the prospect of implementing geothermal heat in the renovation of Warm Springs State Hospital.

It is necessary for the state to initiate a research and development effort with the following objectives:

1. To determine if the proposed geothermal resource area is adequate;
2. To determine the costs and practicality of retrofitting existing heating systems for use with low temperature geothermal water; and
3. To determine the impact of utilizing geothermal water for heating the buildings on the environment.

If Warm Springs State Hospital were converted to geothermal energy, at least .25 billion cubic feet of natural gas would be conserved. The state of Montana also has an opportunity (some would argue "obligation") to convert its other building complexes from natural gas to some other energy source. In many cases, coal would be the most economic choice; however, coal's polluting characteristics must be fully considered before any conversions are undertaken. I suspect that the citizens of Missoula, for instance, would move on Helena, in mass, if the state proposed to further degrade Missoula's air quality with a polluting coal-burning heating plant at the University of Montana. The state of Montana has a tremendous reservoir of talent within the university system. The universities should take the lead in developing innovative solutions to their natural gas supply problems. Many state building complexes are in areas with sizable potential for the implementation of renewable energy resources. This potential should not be ignored.

Over the past decade, energy consumption in Montana industry has grown faster than the energy consumption of any other sector. Montana industries currently consume 35 percent of the total energy used in the state. Montana industry consumes over 40 percent of all natural gas sold within the state as well as over 60 percent of all electricity. In 1974, Montana industry consumed over 36 billion cubic feet of natural gas. This energy use is concentrated in a few basic industries (metal mining and processing, wood products and paper, oil refining, food products, and cement). For example, in 1974, the Anaconda Company and Hoerner Waldorf together consumed over 40 percent of all the natural gas distributed to industry.

In recent years, Montana industry has also done a good job in conserving energy and converting from natural gas to other fuels. By 1980, researchers have been able to project a decrease in industrial natural gas consumption of between 7 and 8 billion cubic feet due to conservation and fuel conversion measures. The stimulus for this has been both a fear of fuel shortage and the simple economic benefits of conservation and conversion. Energy costs are often a very sizable portion of industrial operating costs, and conservation has a real dollar impact to industry.

As I mentioned previously, economic stimulus plays a powerful role in industrial energy conservation. We are not proposing, at this time, any new mandatory programs for industrial energy conservation. Our emphasis will primarily be on education, focusing on energy management and energy auditing.

Efficient energy management is the keystone of industrial energy conservation, and energy auditing is the first step toward efficient energy management. Energy auditing systematically indicates exactly were and how

much energy is consumed in an industrial process. The audit likely would reveal areas where energy could be used more efficiently. Energy audits are being conducted by industries all over the united States, and energy savings of at least 10 to 15 percent have been reported in certain instances simply by implementing housekeeping and other cost effective conservation measures.

Through our proposed educational program, personnel from the State Energy Office will visit every major industry within the state of Montana and present information on energy management along with specific examples of energy auditing methodology and its benefits. Follow-up procedures will also be initiated. If this program is successful to the extent that it reduces overall industrial energy consumption by 2 percent by 1980, an additional .7 trillion Btu's of natural gas could be saved.

I belive that the previous research and projections made by MERDI and the Environmental Quality Council are adequate to project future industrial natural gas demand. MERDI industrial natural gas demand projections are shown in Figure 3.

In summary, we have proposed a substantial, long range, coordinated program to apply energy conservation measures and utilize renewable resources. This program will permit these technologies to become a major energy supply technology. These measures give the state of Montana a major responsibility in assuring energy supplies. This effort must be taken every bit as seriously as our utilities currently take energy distribution and power generation facility planning and construction. This is a task not to be taken lightly or piecemeal.

I cannot stand before you tonight and assure you absolutely that if the state takes the actions we have proposed that the exact amount of energy we have projected will be conserved. Projections are a "best guess" of what will happen in the future based on numerous assumptions. If our assumptions do not match reality, our projections will be wrong. There are many variables that simply cannot be quantified. Thus, in addition to adopting the measures outlined, the state must very carefully monitor patterns in energy consumption within Montana to insure that the various program measures are indeed having the desired effect. The worst mistake that the state could make would be to do nothing.

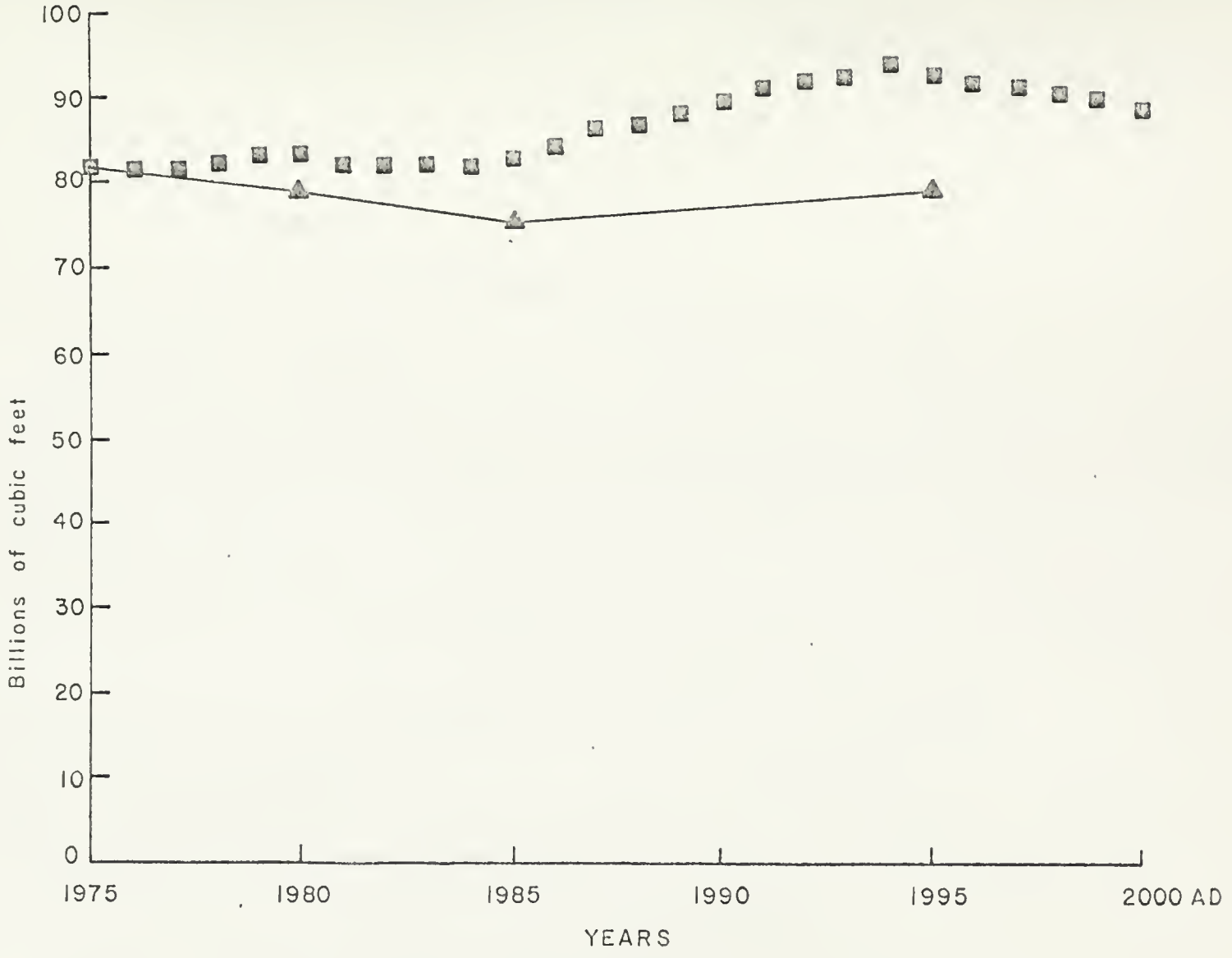

Figure 1.--Natural Gas Conservation in the Residential Sector Due to Implementation of the Conservation Plan

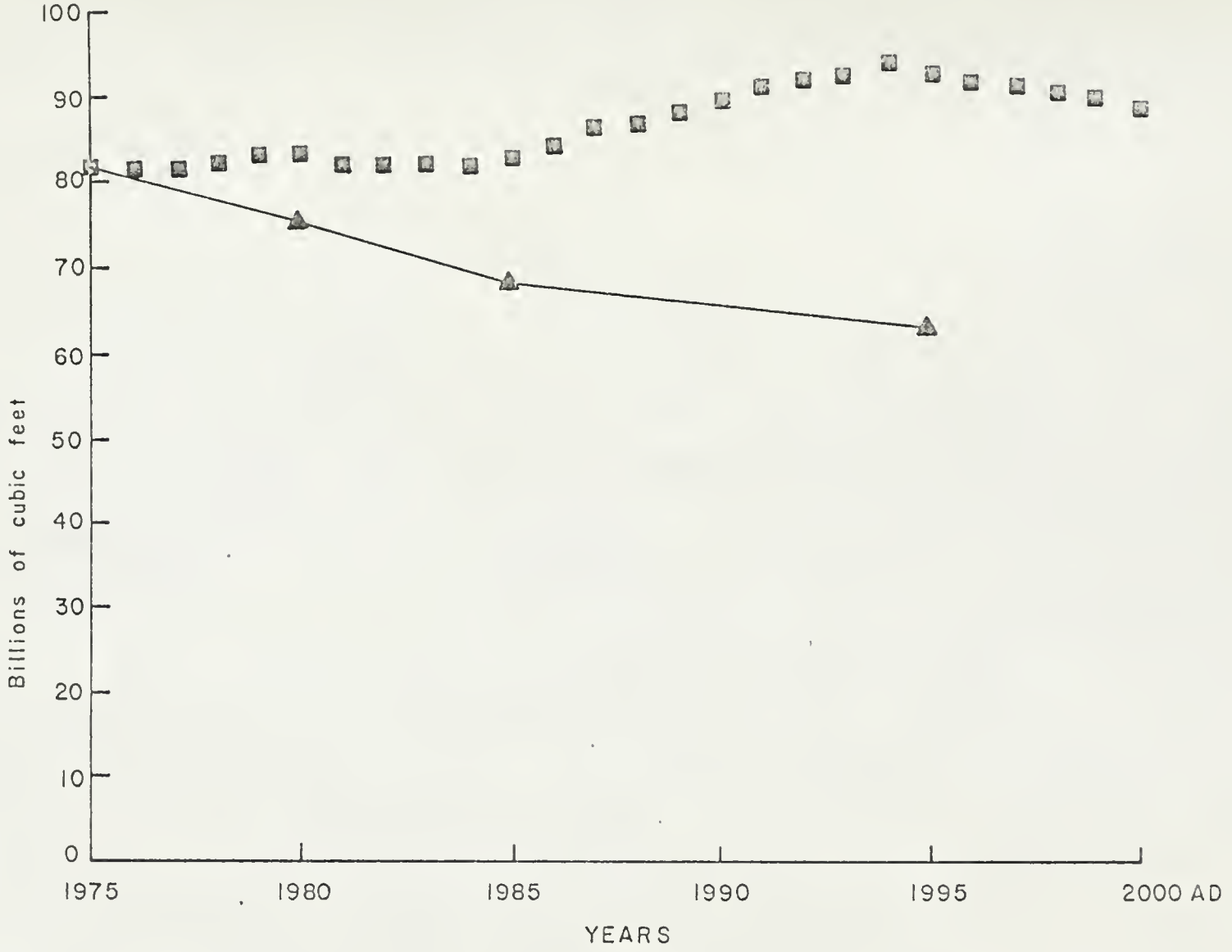

Figure 2.--Natural Gas Conservation in the Residential and Commercial Sectors Due to Implementation of the Conservation Plan

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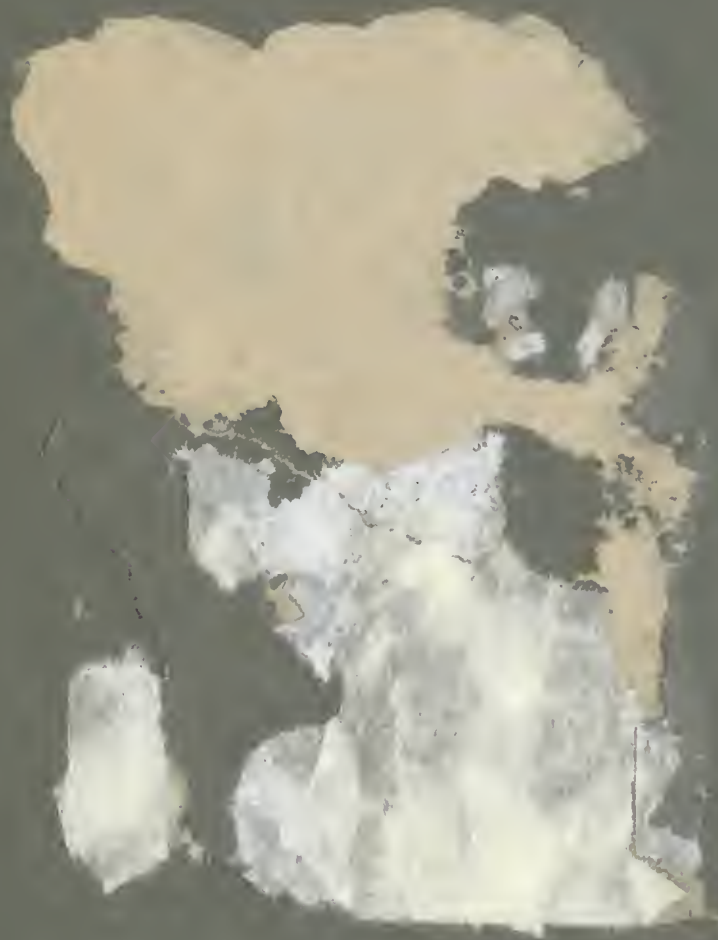
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